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THE INTERRELATIONSHIP OF VARIOUS BIOLOGICAL, SOCIAL AND ECONOMIC FACTORS IN THE SPORT FISHERY OF MOOSE LAKE, ALBERTA

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AND WILDLIFE

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THE INTERRELATIONSHIP OF VARIOUS BIOLOGICAL, SOCIAL AND ECONOMIC FACTORS IN THE SPORT FISHERY OF MOOSE LAKE, ALBERTA

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Progress Report #2
March, 1969

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THE INTERRELATIONSHIP OF VARIOUS BIOLOGICAL SOCIAL AND ECONOMIC FACTORS IN THE SPORT FISHERY OF MOOSE LAKE, ALBERTA

Introduction

If fisheries management agencies are to satisfy the recreational requirements of our rapidly expanding population, it is imperative that their personnel acquire a sound understanding of the economic and social factors that influence fisheries development and utilization. It is sometimes necessary to compromise the fish's needs in order to satisfy those of mankind, but fortunately, in most cases, fisheries development can be compatible with mineral, industrial, agricultural and social development. Some economists and industrialists argue against the protection of the fisheries resource on the grounds that more social good and greater economic gain can be derived from other water uses. In most cases their arguments are unfounded. It is true, however, that we as fishery managers must not sit back and defend our resource with glorious phrases describing its aesthetic virtues. We must be prepared to argue its protection on economic and social grounds for, if we do not, we will surely lose much of that which we have been given the responsibility to protect.

In 1966, the Fish and Wildlife Division of the Government of Alberta initiated an intensive investigation of a single warm water sport fishery in the east central portion of Alberta to determine the interrelationship of various biological, social and economic factors in the fishery. In an earlier report the writer outlined the study methods in detail. (McDonald 1967). He also summarized the 1966 data. It is the purpose of this report to present the 1967 data and discuss the conclusions derived from it.

Sport Fishery Statistics - 1967

The Schupp technique (Schupp 1964) was used again in 1967 to sample the areas around the lake used by the general public. Sampling was carried out continuously from May 20 to September 12 inclusive. Those anglers using private property were sampled with a mail questionairre.

The number of areas sampled by the Schupp technique remained at 12, as in 1966, but 3 areas were re-located on the basis of the 1966 data. The location of the 1967 sampling areas is shown in Figure 1.

The sampling schedule was modified in 1967 to eliminate the overlap in time periods which occurred in 1966. The working day was thereby reduced to 7.5 hours consisting of 3 consecutive 2.5 hour sampling periods. (Table 1)

One person worked 6 out of every 8 days on an alternating early and late day basis to conduct the sampling. The basic sampling unit was the number of anglers who completed fishing trips in a specific area within the 2.5 hour sampling period.

During the 116 day census period in 1967, 2.84% or 237 out of 8,352 possible sampling units were actually sampled.

A summary of the sport fishery effort and catch statistics compiled for the anglers utilizing public areas in 1967 is presented in Table 2. The formulas used to compute these statistics are presented in the 1966 report. (McDonald 1967).

Additional statistics not included in Table 2 are:

a) Mean length of a fishing trip - 3.01 hours

b) Mean party size in fishing boats - 2.1 persons

c) Mean party size in pleasure boats - 3.4 persons

d) Mean number of fish caught per boat-trip - 7.1

e) Mean number of fish caught per man-trips in boats - 2.3

f) Mean number of fish caught per man-trip at bridges - 0.5

g) Mean number of fish caught per angler-hour - 0.6

h) Percentage composition of the catch from fishing boats:
Pike - 38.2%
Perch - 37.5%
Walleye - 24.3%

i) Percentage composition of the catch taken from bridges:
Pike - 70.5%
Perch - 16.6%
Walleye - 12.8%

j) Mean weight of fish in the total catch:
Pike - 1.72 pounds
Perch - 0.62 pounds
Walleye - 1.71 pounds

Most of the 1967 statistics compare closely with those observed in 1966, although the percentage composition of the catch varied markedly between the two years. The latter situation is probably due to the fact that the 1966 data only covers the period May 15 - July 15 while the 1967 figures represent the whole summer's data. Previous studies by Thomas (1963) and the writer (McDonald 1964) have shown that most of the walleye and perch are captured in Moose Lake between May 15 and July 15. For example, in 1967, 88.5% of the walleye and 94.2% of the perch were taken during this period compared to only 60.7% of the Northern pike.

The catch per unit of effort remained the same for the general public in 1967 as in 1966, 0.6 fish per man-hour of angling.

An examination of Table 2 reveals that the bulk of angling activity is concentrated at 5 areas on Moose Lake. In decreasing order of activity these areas are the bridge near Franchere (area 7), Franchere beach (area 8), railway bridge (area 6), Eastbourne campsite (area 11) and Vezeau Beach (area 1). Most of the angling activity occurs in the western half of Moose Lake.

The census records show that for every five fish that were kept by anglers, one was released. The statistics do not include released fish.

The sampling of anglers using private property was carried out by randomly selecting 50 property owners from the 128 around the lake. Each of these was sent a form letter (Appendix A) requesting their assistance in keeping a record of the angling activity on their property in 1967. Replies were received from 10 people and 9 of these agreed to compile records. No follow-up letters were sent. Of the 9 people who offerred to co-operate, 7 have since forwarded a record of the information that was requested. They represent 5.5% of the total number of private property owners on Moose Lake.

Their response shows that 424 man-trips for fishing were made from 7 private sites and that 2,144 man-hours were expended to catch 703 walleye, 724 pike and 545 perch. This represents a catch efficiency rate of .92 fish per man-hour of angling, 50% greater than that recorded for the general public. One would expect this to be the case as the average property owner on Moose Lake is more familiar with the better fishing areas than is the transient angler. One of the 7 forms indicated that no fishing trips originated at one private property site in 1967.

Unfortunately, the large standard deviation of the catch and effort statistics supplied by the sample of 7 owners will not permit calculation of similar statistics for the whole population within reasonable confidence limits. If we accept the premise that the data supplied by the 7 respondents is 25% too high on the average, then we can estimate that, in 1967, 5,818 angling trips originated on private property at Moose Lake. These trips resulted in the harvest of 27,008 fish during 29,440 man-hours of fishing.

Combining these figures with those from Table 2, we can estimate that during the period May - September, 1967, 22,023 angling trips resulted in the

catch of 52,635 fish during 74,590 hours of angling. The fish weighed a total of 78,205 pounds representing an average rate of harvest by angling of 7.54 pounds of fish per surface acre of water.

Moose Lake also yielded 32,218 pounds of fish to a commercial fishery in May, 1967. (Table 3). The lake therefore supported an average yield of at least 10.9 pounds of fish per surface acre in 1967. This is a minimum figure as it does not include those fish taken by angling early in the spring, late in the fall or during the winter. As Moose Lake is rapidly becoming a popular winter fishery, we can assume that the catch of fish during that time was considerable.

Most people fishing from private property used boats and they succeeded in catching more walleye than the transient anglers. 35.7% of the property owner's catch was walleye compared to only 24.3% of the general public's catch. The catch of pike was about the same for both groups. As the walleye is generally regarded as the most desirable game fish species in Moose Lake, the private property owners are again noted to be more successful than the general public.

It is interesting to note that anglers caught 17.8 times as many pounds of walleye in Moose Lake in 1967 as did the commercial fishermen. This fact reflects the effectiveness of the area restrictions imposed on the commercial fishery.

Tag Return Data

767 game fish were live-captured, mostly by angling, and marked with individually numbered clear vinyl dart tags in 1967. They were released into the lake following a 48 hour observation period. During a similar operation in 1966, 1,436 fish were marked with yellow dart tags and released following a 24 hour observation period. The composite rate of mortality from handling and tagging was 7.5% in 1966 and 8.9% in 1967. The difference is not significant at the

5% level. The intraspecific variation in mortality rates between the two years were, for pike, 12.4% and 9.1%; for walleye, 10.1% and 11.1% and, for perch, 3.1% and 6.0%. None of these differences is significant at the 5% level. It is therefore concluded that a 48 hour observation period has no significant advantage over a 24 hour observation period for determining post-tagging mortalities when dart tags are used on pike, perch, or walleye.

In 1966 there was a significant interspecific difference in the post-tagging mortality rate of perch and both pike and walleye. This difference was less obvious in 1967 when the mortality rate of perch increased. The latter situation was probably due to the use of 2 inch square mesh wire in the holding pen which allowed the perch to entangle themselves in it. Some of them may have died as a result. In 1966, the holding pens were of 1 inch square mesh wire which was small enough to prevent this occurrence.

As in 1966, a reward payment of one dollar was made for each tag returned from a recaptured fish. This facilitated the collection of data regarding the location and dates of tagged fish recaptures.

In the two year period up to June 1st, 1968, 131 or 9.12% of the 1436 fish tagged in 1966 were recaptured by anglers; 18.54% of the pike, 13.98% of the walleye and 1.3% of the perch were recovered. Of the 767 fish tagged in 1967, 30 or 3.91% have been recovered in the past year compared to the 5.84% recovery rate recorded in the first year following the 1966 tagging. By species, the first year tag recovery rates for fish tagged in 1966 and 1967 respectively are: Pike, 11.22% and 5.42%; Walleye, 9.21% and 5.74%; Perch, 0.81% and 0.40%. None of these differences is significant at the 5% level. The decline in the first year tag recovery rates in 1967 probably reflects a higher incidence of unreported tags rather than a lower percentage of tagged fish recaptures.

The location of all tagged pike, walleye and perch recaptures up to May 31st, 1968 is shown in Figures 2, 3, and 4 respectively. Most of the pike have been recaptured within one mile of the original release site as have the perch. The walleye have distributed themselves throughout Moose Lake although several areas of concentration are evident. The greatest direct inlake distances from the point of release to recapture for pike, walleye and perch are 7 miles, 8 miles and 5¾ miles respectively.

It is interesting to note that on 12 separate occasions, two or more tagged fish were recaptured in a single day from the same fishing boat. On two occasions, single anglers captured 3 tagged fish in one day. Considering fish taken on various dates throughout 1966 and 1967, 20 families have captured two or more tagged fish in Moose Lake. One family caught 5 tagged walleye and one tagged perch in a single 19 day period in June, 1967.

Socio-economic data

a) Size of fishing parties

One person -14.9%
Two persons -46.0%
Three persons -20.7%
Four persons -13.8%
Five persons - 4.0%
More than five persons - 0.6%

b) Use of boats for angling purposes

60.1% of the anglers at Moose Lake fished from boats, 32% from bridges and 7.9% from shore.

c) Methods of angling

The methods of angling ranked according to the percentage of anglers using each method is as follows:

Spinfishing - 27.0%
Casting - 25.6%

Trolling	- 23.6%
Jigging	- 12.4%
Baitfishing	- 10.3%
Flyfishing	- 1.1%

d) Species preferences of anglers

The type of fish that anglers most prefer to catch ranked according to their 1st, 2nd and 3rd choice are as follows:

CHOICE	WALLEYE	PIKE	PERCH
1st choice	80.4%	12.1%	7.5%
2nd choice	11.1%	45.8%	43.1%
3rd choice	6.8%	49.1%	44.1%

Walleye are obviously the most popular game fish with second and third choice preferences almost equally divided between pike and perch.

e) Origin of anglers

Only 15.5% of the anglers contacted in 1967 lived in the Moose Lake-Bonnyville-Glendon area while 36.2% lived in Edmonton and 48.3% lived in one of more than 35 different cities, towns and villages in Alberta, British Columbia, Saskatchewan, Manitoba, Ontario and the U.S.A.

24.2% of the anglers had changed their place of residence within the past year. This figure undoubtedly reflects the high rate of transfer experienced by military personnel from nearby Cold Lake Air Force Base, many of whom fish in Moose Lake.

f) Primary purpose of trips to Moose Lake

For fishing	- 52.2%
Camping	- 14.3%
Boating	- 8.1%
Swimming	- 7.4%
Sight-seeing	- 6.5%
Picnicing	- 5.3%

Business	- 0.9%
Others	- 5.3%

It is interesting to note that only half of those people engaged in angling have come to the lake specifically for that purpose. Many of them fish as a secondary consideration to other activities such as camping, boating, etc.

g) Activities of anglers at Moose Lake

In addition to fishing, the percentage participation of anglers in other outdoor activities while at Moose Lake is as follows:

Camping	- 35.5%
Boating	- 35.5%
Swimming	- 23.5%
Sight-seeing	- 18.5%
Picnicing	- 15.0%
Photography	- 7.0%
Golfing	- 5.0%
Water Skiing	- 4.5%
Others	- 4.0%

h) Influence of fishing opportunity on recreational utilization of Moose Lake

66.8% of the people indicated they would not go to Moose Lake if fishing were not available. The remainder said that the lake's other attractions would draw them to it regardless of the fishing opportunity.

74.7% of the respondents indicated that they do not visit Moose Lake except during the summer period. Two out of three of those who do visit the lake in the spring, fall or winter do so for fishing.

i) Moose Lake as a primary or secondary recreational objective

83% of the anglers indicated that Moose Lake was their primary objective while the others said that it was just a stop-over on a more extensive holiday

trip.

j) Duration of trips to Moose Lake

54.8% of the people contacted during the census were at the lake for the weekend, 22.4% for their vacation period, 22.4% for their day off and only 0.4% for an unspecified length of time.

k) Family participation in trips to Moose Lake

44.3% of the 1967 respondents were at the lake with members of their families while the remainder were alone or with friends. The mean family size was 1.06 men, 1.02 women and 1.46 children. Two thirds of those who were alone indicated that their families accompanied them to Moose Lake occasionally while the other third said they never brought their families to the lake.

l) Age of anglers

The percentage distribution of anglers at Moose Lake according to their age was as follows:

up to 16 years - 0.0%
16 - 20 years - 3.6%
21 - 30 years - 24.1%
31 - 40 years - 25.0%
41 - 50 years - 30.4%
51 - 60 years - 13.4%
61 - 70 years - 3.6%
over 70 years - 0.0%

m) Occupation of anglers

The distribution of anglers at Moose Lake according to their occupation was as follows:

Professional - 5.03%
Manager, Proprietor - 5.03%

Clerical, sales - 5.88%
Skilled workers - 15.29%
Semi-skilled workers - 8.82%
Farming, ranching - 7.65%
Labor - 7.06%
Government - 7.06%
Students - 1.18%
Retired - 1.76%
Not specified - 34.70%

n) Types of accommodation used by anglers

The types of accommodation used by anglers and their comparative use is shown in Figure 5. Anglers using private cabins were not included in the sample.

o) Types of accommodation most preferred by anglers

Figure 6 shows the comparative angler preference for various types of accommodation including private cabins. It is significant to note that, if given the opportunity, more anglers would stay in trailers, rental cabins and private cabins than are presently doing so. The use of hotel, motel and home accommodation would decrease.

p) Use of boats

54.8% of the anglers at Moose Lake owned boats while 46.6% indicated that they rented boats occasionally. Only 1.1% of the anglers owned a boat and rented one occasionally as well.

q) Distance travelled by anglers

The mean round trip distance travelled by anglers to fish in Moose Lake in 1967 was 231 miles. This compares favorably with the mean round trip distance of 234 miles per angler calculated from the 1966 data.

Altogether, anglers travelled a total distance of at least 3,456,000 miles to fish in Moose Lake in 1967. This figure does not include the mileage of those anglers who stayed at private cabins or fished Moose Lake during the period January 1st - May 1st or September 15th - December 31st, 1967.

According to the 1966 data, the mean number of anglers per vehicle was 1.65. Using this figure, it is estimated that at least 9,091 separate vehicle trips to Moose Lake were made in 1967 and these trips covered a total round trip distance of over 2,136,000 miles.

r) Frequency of fishing trips to Moose Lake

The average number of fishing trips that anglers make to Moose Lake during the summer and winter seasons is as follows:

Number of trips	Summer	Winter
Less than one	3.6%	74.7%
1 - 2	39.5%	10.0%
3 - 6	31.7%	8.1%
More than 6	25.2%	7.2%

s) Popularity of other sport fishing lakes in the Moose Lake region

58.9% of the anglers contacted in 1967 indicated that they had fished at least one of 31 other lakes in the Moose Lake region. The seven lakes most frequently mentioned, ranking in decreasing order of popularity, were Muriel, Mann, Crane, Cold, Beaver, Garner and Wolf Lake.

t) Distance anglers are willing to travel for fishing

Figure 7 shows the one way distance which anglers are willing to travel for one day of fishing, while Figure 8 presents the same information for a weekend trip.

Only one out of every four anglers is willing to travel more than 200 miles round trip to fish for one day, while 61.8% are willing to travel that

far for a weekend trip.

u) Quality of fishing trips to Moose Lake

Only 9% of the anglers rated their fishing trip to Moose Lake as excellent, 27% as good, 30% as average and 34% as poor.

v) Aesthetic quality of Moose Lake

The natural beauty of Moose Lake including its beaches, water and surrounding scenery was rated as excellent by 18.2% of the fishermen, good by 59.1%, average by 20.9% and poor by 1.8%.

The generally lower rating given to the quality of the fishing trips in the preceding section appears to be due to the inability of angler's to satisfy their expectation as far as catching fish is concerned. They appear to regard Moose Lake's other attributes as average or better.

w) The length of time which anglers have been going to Moose Lake

40.2% of the anglers have been going to Moose Lake for more than 5 years while 8.4% indicated that this was their first trip. 35.5% of the anglers have been going to the lake for 1 - 3 years and 15.9% for 3 - 5 years.

x) Boat launching facilities

71.6% of the anglers regarded the present boat launching facilities as adequate while the remainder did not.

Suggestions for improvement included the construction of more docks and the use of concrete to build boat launching ramps.

y) Road improvement in Moose Lake area

Opinions regarding the condition of the various stretches of provincial highway connecting with Moose Lake were as follows:

i) Highway 28A - Ashmont to Moose Lake

Excellent - 9.7%
Good - 63.1%
Fair - 22.3%
Poor - 4.9%

ii) Highway 28 - St. Paul to Bonnyville

Excellent - 4.8%
Good - 61.3%
Fair - 24.2%
Poor - 9.7%

iii) Highway 28 - Edmonton to Ashmont

Excellent - 34.1%
Good - 64.7%
Fair - 1.2%
Poor - 0.0%

In general, the highway conditions were regarded as much above average with the gravelled stretch of Highway 28 from St. Paul to Bonnyville rated as the poorest.

z) Use of roads in the Moose Lake area

41.4% of the anglers travelled along Highway 28A from Ashmont to Moose Lake while 25.6% reached the lake via Highway 28 from Kehiwin Lake. 14.6% of the people used Highway 28 from Cold Lake and 18.2% used the gravel road from Glendon to the lake.

aa) Road Improvement

38.5% of the 1967 respondents indicated that the local gravel roads in the Moose Lake area required improvement, 23% indicated that they did not and 38.5% had no opinion.

bb) Need for more campgrounds

32.4% of the anglers felt that more campgrounds were necessary on the lake, 30% replied to the negative and 38.6% expressed no opinion.

cc) Type of camping areas preferred

83.8% of the people indicated that, when camping they preferred to stay in an area with camp shelters, toilets, good access and towns nearby. Only 16.2% preferred to camp in a wilderness area lacking all of these conveniences.

dd) Provincial Park development

When asked whether or not they would like to see a Provincial Park developed on Moose Lake, 84.7% replied yes and 15.3% replied no.

ee) Quality of existing campgrounds

Excellent	- 11.6%
Good	- 61.6%
Fair	- 25.9%
Poor	- 0.9%

ff) Quality of existing toilet facilities

Excellent	- 11.5%
Good	- 51.0%
Fair	- 34.6%
Poor	- 2.9%

gg) Quality of existing drinking water supplies

Excellent	- 7.8%
Good	- 43.1%
Fair	- 37.2%
Poor	- 11.9%

hh) Ownership of private cabins on lakes other than Moose Lake

The segment of the sample population that did not own a private cabin on

Moose Lake was asked to indicate whether they owned such property on any other lake in Alberta. 4.5% indicated that they did.

ii) Recreational use of other lakes in the Moose Lake region for purposes other than fishing

23.4% of the anglers at Moose Lake indicated that they visited other lakes in the Moose Lake region for purposes other than fishing. These purposes included water-skiing, swimming, boating, and camping.

jj) Factors contributing to the success of a fishing trip

Anglers were asked to express their opinion regarding the single factor which they felt contributed the most to making their fishing trip successful. They were given a choice of the following:

1. Good weather conditions.
2. Good facilities.
3. Catching a few very large fish.
4. The beauty of the country and the lake itself.
5. Catching a lot of fish.

30.2% regarded the weather as being the most important factor followed by large fish - 26.4%, natural beauty of countryside - 19.5%, good facilities - 12.6% and a lot of fish - 11.3%.

The answers to this question in 1967 varied significantly from those received in 1966. Only 13.8% regarded the weather as being the most important factor in 1966 compared to 30.9% for large fish, 28.8% for natural beauty, 19.1% for lots of fish and 7.4% for good facilities. The reason for the variation between the two years is not known.

kk) Fishing license fees

88.5% of the anglers contacted in 1967 felt that the fishing license fee of two dollars should remain that amount while 5.3% favored a one dollar increase, 1.8% favored a two dollar increase, and 4.4% felt that it should be reduced.

ll) Income of anglers

The income range of anglers who do not own private property at Moose Lake:

up to $2,500 per annum - 10.1%
$2,501 to $5,000 per annum - 33.3%
$5,001 to $7,500 per annum - 40.4%
$7,501 to $10,000 per annum - 15.2%
more than $10,000 per annum - 1.0%

mm) Expenditures of anglers

Anglers who did not own property on Moose Lake were asked to indicate the amount of money they had spent in the Moose Lake - Bonnyville area in the 24 hour period immediately preceding their interview. A breakdown of how the angler's dollar was spent in 1967 is shown in Figure 9. The mean daily expenditure of an angler in the Moose Lake - Bonnyville area in 1967 was $11.10. This compares favourably with that calculated from the 1966 data of $10.04 per day. Using the 1967 figures, it is estimated that during the summer period of 1967, the anglers who fished Moose Lake spent at least $166,500 in the Bonnyville trading area. This figure is exclusive of the expenditures of the anglers who fished from private property, who fished other lakes in the area or who fished during the other 7½ months of the year.

nn) Private property owners

Although too few mail questionnaires were returned by private property owners to permit an assessment of factors relating to this whole group, it is possible to identify several areas where significant differences probably occur between property owners and the public at large.

These areas are as follows:

1. Age

The age of six property owners who responded to the questionairre varied between 47 - 62 with the mean age being 54.1 years.

2. Place of residence

Three of the six owners lived in the Moose Lake - Bonnyville area.

3. Occupation

All six property owners were employed as professionals or proprietors of their own business.

4. Period of property ownership

The period of ownership of property on Moose Lake varied between 3 - 35 years with the mean being 16.3 years.

5. Ownership of boats

All six property owners owned boats.

6. Period of use of property

All six respondents used their property throughout the summer while only one used it at all during the winter.

7. Rental of property to other persons

Four of the six property owners leased or rented their property on an annual basis to other people for varying lengths of time.

8. Income range

Four of the six property owners earned an annual income in excess of $10,000 per year while one earned between $2,000 - $3,999 and the other earned $8,000 - $9,999.

9. Expenditures

Although the writer was unable to calculate expenditure data for private property owners from his study, Nowicki[1] has supplied information concerning this subject. In a recreational study which he conducted in 1967, he contacted all 88 cottage owners on Moose Lake and asked them to summarize their expenditures within the area during the previous 12 months. He received 55 replies, 25 of which were from people who normally resided outside the study area. Of the latter group, 3 supplied incomplete expenditure data but the remaining 22 indicated a total expenditure of $19,595 in the Moose Lake - Bonnyville area in 1967. Individual expenditures ranged from $276 to $2,760 with a mean expenditure of $891 per cottage owner. Unfortunately, the large standard deviation of the sample ($770) does not permit calculation of an expenditure figure for the whole group within reasonable confidence limits.

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[1] Nowicki, Julian - Department of Geography, University of Alberta, Edmonton
Personal communication.

Summary

1. During the 116 day period between May 20 and September 12, 1967, 15,000 man-trips to Moose Lake for fishing resulted in the capture of 25,627 fish during 45,150 hours of angling. This figure excludes an additional number of angling trips completed by the users of private property during the same period. The latter figure is estimated to be a minimum of 5,818 angling trips resulting in the capture of 27,008 fish during 29,440 hours of angling.

2. Total estimates of angling effort and catch during the 116 day period are 22,023 angling trips completed to catch 52,635 fish during 74,590 hours of angling.

3. Moose Lake supported an average yield of at least 10.9 pounds of fish per surface acre in 1967.

4. Anglers caught twice as many walleye from boats as from shore.

5. The catch rate increased slightly in 1967 to 0.7 fish per hour from 0.6 fish per hour in 1966.

6. 88.5% of the walleye and 94.5% of the perch were captured during the first half of the census period. (May 20 - July 15).

7. Persons owning private property on Moose Lake were 50% more successful in catching fish than were non-property owners.

8. A 48 hour observation period has no significant advantage over a 24 hour observation period for assessing post-tagging mortality of pike, perch or walleye marked with spaghetti dart tags.

9. Post-tagging mortality rates in two successive years when spaghetti dart tags were used on three species of fish were as follows: pike, 12.4% and

9.1% walleye, 10.1% and 11.1% and perch, 3.1% and 6.0%.

10. In a two year period, the tag returns from three species of fish captured by angling were as follows: pike, 18.54% walleye, 13.98% and perch 1.3%.

11. Most pike and perch were recaptured within one mile of the original release site while walleye distributed themselves throughout the lake.

12. Four out of five anglers cited walleye as the most preferred game fish species where pike and perch are also present.

13. 84.6% of the anglers at Moose Lake reside outside the local trading area.

14. During the 116 day census period in 1967, 9,091 separate vehicle trips to Moose Lake covered a total distance of 2,136,000 miles with the average round trip distance being 231 miles.

15. Less than 25% of the anglers are willing to travel more than 200 miles round trip to fish for one day.

16. Anglers spent a minimum of $166,500 in the Bonnyville - Moose Lake area during the late spring and summer of 1967. Automobile expenses accounted for the largest portion of this expenditure followed in decreasing order by entertainment, groceries and meats, meals at a restaurant or drive-in, fishing tackle and boat rental and launching fees. Accessories, camping equipment and bait were the items of least expenditure.

17. Forty of the 88 cottage owners at Moose Lake live outside the local area. 22 of these people spent a total of $19,595 in the area in 1967, or an average of $891 per cottage owner.

Discussion and Conclusions

In recent years, biologists and economists alike have tried to define the value of sport fishing as it relates to the economy of a geographic region or to the participants themselves. The methods and objectives of these studies have been as diverse as the question itself. The best discussion of this whole subject is reported in a series of papers presented at a symposium on "The Economic Aspects of Sport Fishing" held in Ottawa in 1965.[2] At this meeting, Clawson (1965) expressed his view that "while fishermen and other recreationists from relatively distant parts do bring some additional money into the local recreation area, yet more of the business they generate is likely to be in their home towns . . . For the typical vacation type recreation area, it seems probable that less than half of the direct expenditures by recreationists is for locally provided goods and services...."

Does this mean that the regional development of sport fisheries resource will add very little to the economy of the local region? The answer to that question apparently depends on the amount of money which the fraction "less than half" represents. Of necessity, rural areas must develop their natural resources to benefit themselves economically and such development will therefore be concentrated on those resources which have a proven economic return. Unless it can be demonstrated that the natural resources of fish and wildlife, which provide the base for much of the outdoor recreational resource, can be utilized to bring substantial income into the local areas, very little will be done to ensure their development and conservation.

Hopefully, this study will help convince small town businessmen, rural landowners and government agencies that sport fisheries can play an integral part in regional economic and social development.

[2] "Economic Aspects of Sport Fishing" Canadian Fisheries Report No. 4 Dept. of Fisheries, Ottawa, Canada.

In the Bonnyville area in 1967, sport fishermen at Moose Lake spent more than $166,500 in a 4 month period to purchase goods and services provided within the local region. Additional sums of money were spent by anglers using other lakes in the area, fishing during the other 8 months of the year or fishing from private property. Nowicki's information indicates that at least another $35,000 was brought into the area by persons owning private cottages at Moose Lake but who normally resided outside the Bonnyville region. Observation suggests that the occurrence of cabins on Moose Lake can be attributed to the sport fishery as Muriel Lake, located nearby, only has a few cabins on it in spite of the fact that it has more beaches of better quality and is larger in size than Moose Lake. Its water is of better quality for swimming and water sports but its sport fishery is poorer by comparison with Moose Lake.

More than a quarter of a million dollars is presently being spent in the Bonnyville area each year by anglers residing outside the local area and undoubtedly, additional impressive sums of money are being spent in the area by outsiders to enjoy other outdoor recreational persuits such as hunting, boating, camping, water-skiing, swimming, picnicking, etc.

The potential for increased revenue from this income source is tremendous. Biological surveys of several of the lakes in the region (McDonald 1967b, 1967c, 1967d) point toward a sport fishery capability of the region in the magnitude of 130,000 man-days of angling each year. The writer's estimate is based on his knowledge of the biological capacity of lakes such as Moose, Muriel and Wolf to produce game fish populations coupled with the present fishing effort being expended at Moose Lake as indicated by this study. At the present rate of in-area expenditures of $11.10 per man-day of angling as indicated by this study, the untapped recreational potential for sport fishing alone is in excess of $1,500,000 per year.

This potential could be increased even more if present efforts by the Fish and Wildlife Division to establish populations of Rainbow trout in Chatwin Lake and walleye in Muriel Lake are successful.

How can this potential be more fully utilized? The writer wishes to suggest several areas in which improvements can be made to increase local revenue from the sport fishery at Moose Lake alone.

Family involvement in fishing trips to Moose Lake at the present time as indicated by this study is only 44%. This is in spite of the fact that 75% of the angling trips to the lake are for two days or more. This suggests that the lack of recreational facilities at the lake for the enjoyment of other members of the family who do not wish to fish should be improved. There are no supervised swimming areas or playgrounds around the lake at this time. Both of these features should be included in the development of areas designed for public use.

The fact that Moose Lake has attained resort status is borne out by the knowledge that 85% of the anglers presently using the lake are from outside the local area and they travel a mean one-way distance of 115 miles to reach it. Moose Lake presently lacks adequate commercial facilities which are provided at other resort lakes in Alberta such as Pigeon Lake, Lac Ste. Anne, and Pine Lake. These include commercial food services such as drive-in restaurants and hot dog stands as well as commercial forms of entertainment such as dance halls and drive-in movies. Perhaps the reason that very few young people less than 16 years of age are presently fishing in Moose Lake is the failure of the area's other facilities to attract them. No anglers less than 16 years were contacted by this survey and yet a survey[3] conducted in the United States shows that more than 15% of all anglers are 12 - 15 years

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[3] 1965 National Survey of Hunting and Fishing
U.S. Fish and Wildlife Service Resource Publication 27.

of age.

The western half of Moose Lake presently supports most of the fishing activity and this is probably due, in part at least, to the location of most of the large public camp grounds in that area. Campground facilities should be developed along the lake's north and east shorelines to help increase total public accommodation capability and effect a re-distribution of anglers into the less heavily utilized areas of the lake.

The immediate development of a Provincial Park along the lake's north shore on lands in sections 11, 12, 13, 14, township 61, range 7, West of the 4th is strongly recommended. This would certainly attract larger numbers of people from the urban centres of Edmonton and Red Deer into the area and increase the use of the eastern portion of the lake. Several excellent beaches exist along this shoreline and the scenic value of the land adjacent to the lake is high.

The present study indicates that a very high percentage of the anglers fishing in Moose Lake revisit it one or more times each year. This suggests that any investment made to increase the initial attraction of anglers to the lake will result in many of them returning to the lake on subsequent trips. 75% of the anglers contacted during this study have been going to Moose Lake for fishing for more than three years. The sponsorship of fishing contests or derbies is one proven method by which large numbers of anglers can be attracted to an area for the first time. Using similar methods, utilization of the lake during the winter period could be increased. By making ski-doos and fishing huts available for rental and providing food service at the lake during the winter, much could be done to encourage the development of a winter fishery. Developers should realize, however, that most of the fishing activity will be concentrated on weekends during the winter months.

The angler preferences for various types of accommodation as determined by this study indicate that some potential may exist for increased development of rental cabins and motels at Moose Lake. This situation should be investigated in much greater depth before investment is made in this area as this study has shown that, in spite of the preferences cited only 18.4% of the anglers are using private accommodation at the present time. Whether or not this is due to the lack of sufficient numbers of commercial accommodation units is not known.

Eighty per cent of the anglers approaching Moose Lake do so from the west and due to the improvement of secondary access roads in this area many people reach the lake without realizing that the town of Bonnyville is located nearby. Firms providing goods and services to people at the lake's west end are few in number and could probably be increased.

The fact that one-third of all angling trips at Moose Lake are spent on either one of two bridges across rivers tributary to the lake suggests that the construction of fishing platforms in these areas would greatly increase their use potential.

The government should prepare and make available to the public at nominal cost contour maps and biological information relating to surveys conducted on this lake. This information is presently on file in various government offices.

This study has demonstrated the ineffectiveness of a mail questionnaire for obtaining expenditure data from people whose cooperation in recording the same must be solicited. While the mail questionnaire has been commonly employed in economic studies of public expenditures, it has generally been used to obtain information related to past rather than future purchases. Response under such conditions has been fairly satisfactory as evidenced by White (1955) who obtained first, second, third responses to his questionnaire of 41.8%, 25.7%,

and 10.5% respectively. Nowicki obtained a 63.6% response to his mail questionnaire which was sent to all of the cottage owners at Moose Lake, including those contacted by the writer during this study. The slow response (10%) to the writers questionnaire is assumed to be due to the need for people to keep a record of future expenditures, a situation regarded by most as inconvenient and troublesome.

The use of the Schupp sampling techique appears to be generally acceptable for creel censuses on lakes where access is limited, where most people use boats and where little or no private cabin or church camp development has occurred. The latter type of property is a particularly difficult area to sample accurately as far as fishing catch and effort are concerned.

Future studies on Moose Lake should determine the fishing effort and catch during the period September 15 - May 15 and an attempt should be made to determine what effects the establishment of a Provincial Park will have on the lake. Will the park attract additional large numbers of people to the lake or will it just effect a redistribution of those already using it?

Acknowledgements

The writer wishes to thank Julian Nowicki, graduate student in geography at the University of Alberta, for his suggestions concerning the questionnaire and the Bonnyville Chamber of Commerce for their financial assistance in paying the cost of the tag rewards. He is also indebted to numerous residents of the Bonnyville area who provided assistance by acting as tag return station operators throughout the two-year study period. Ralph Harle, Fish and Wildlife Officer at Bonnyville assisted the writer on numerous occasions and this assistance is gratefully acknowledged.

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1967c "Muriel Lake" Unpublished report, Fish and Wildlife Division, Department of Lands and Forests, Edmonton.

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FIGURES

Figure 1 Sampling Areas — Summer Creel Census — 1967

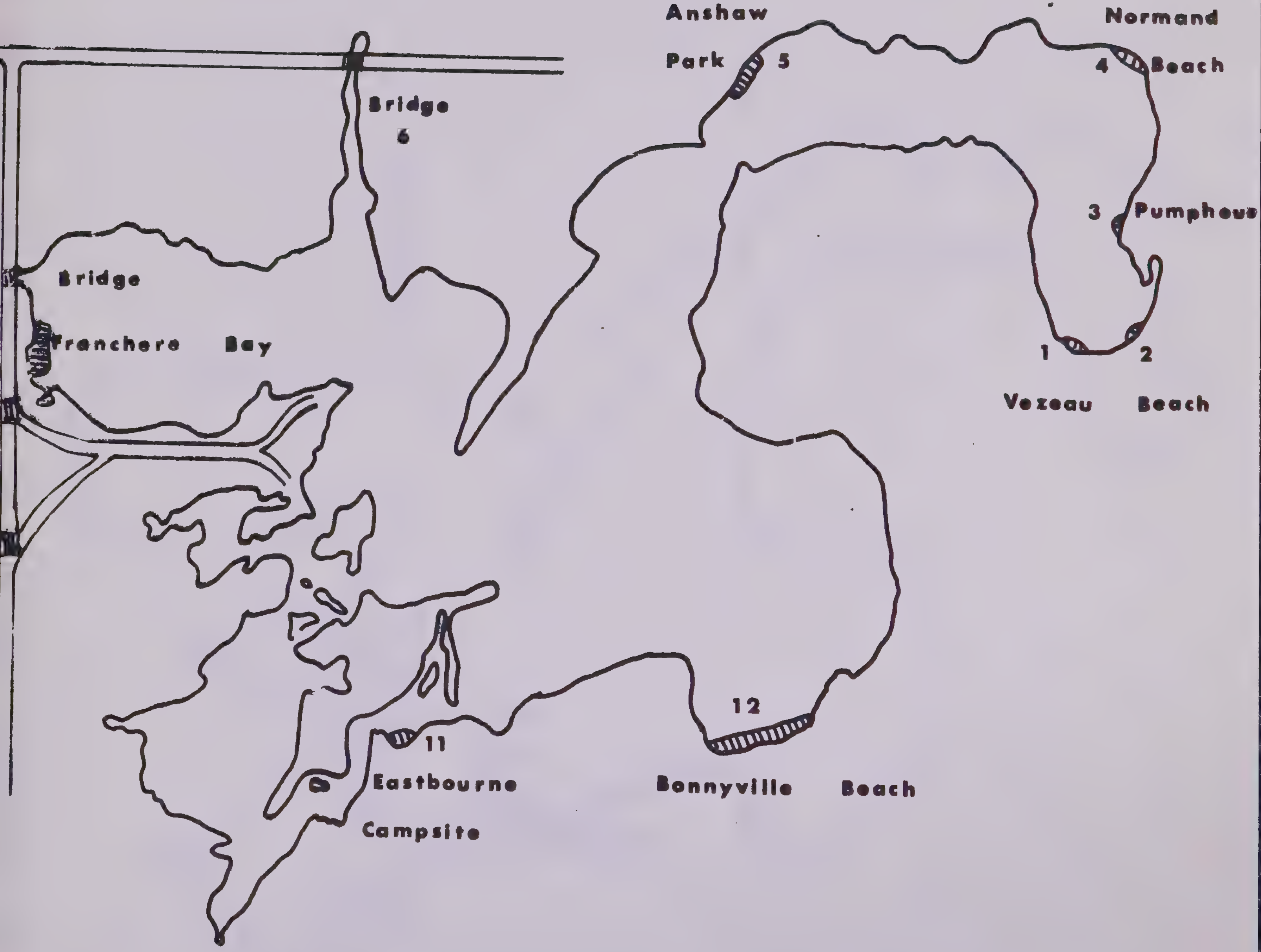


Figure 2 Location of Taggod Northern Pike Recaptures

Up to May, 1968

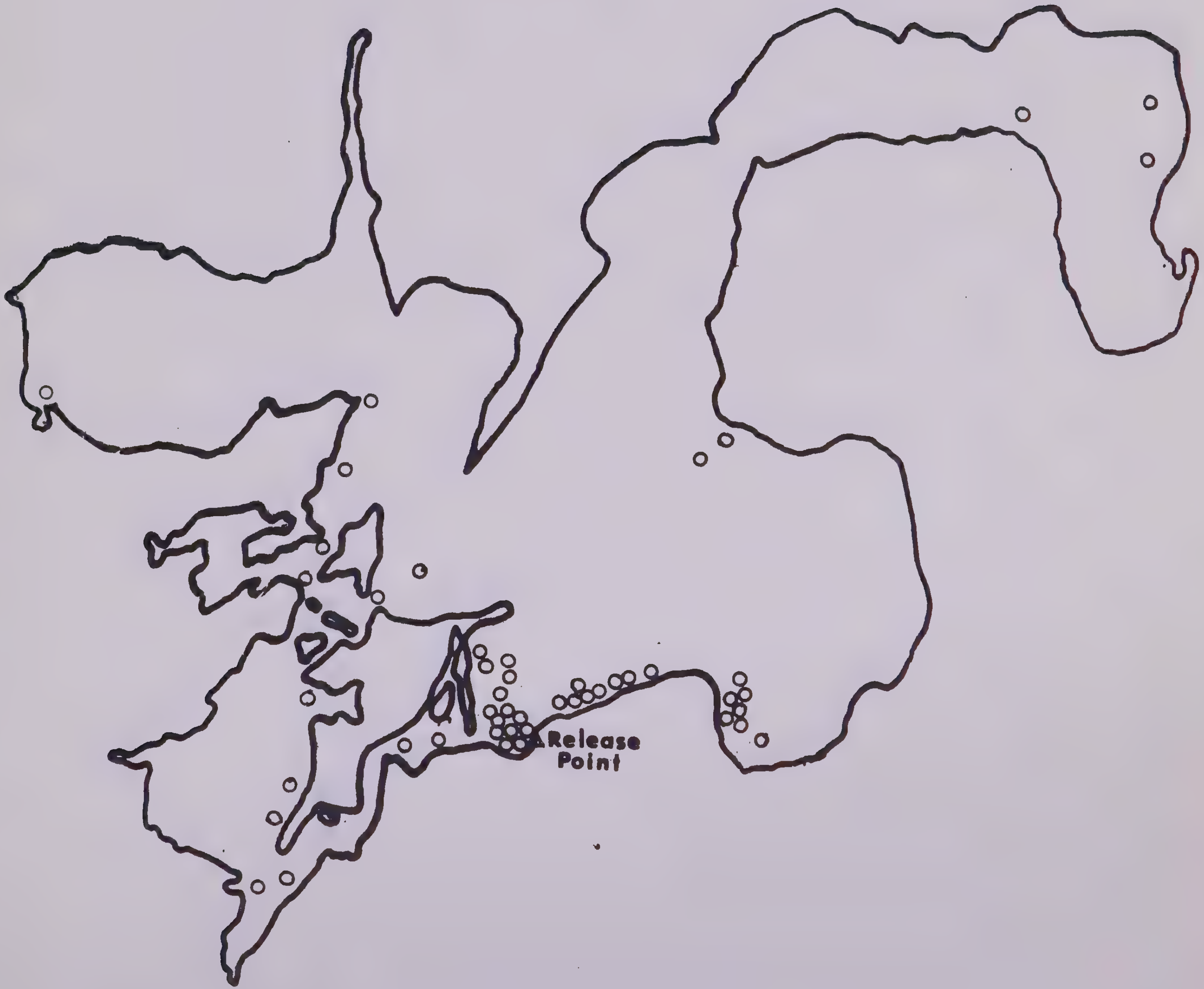


Figure 3 Location of Tagged Yellow Perch Recaptures

Up to May, 1968

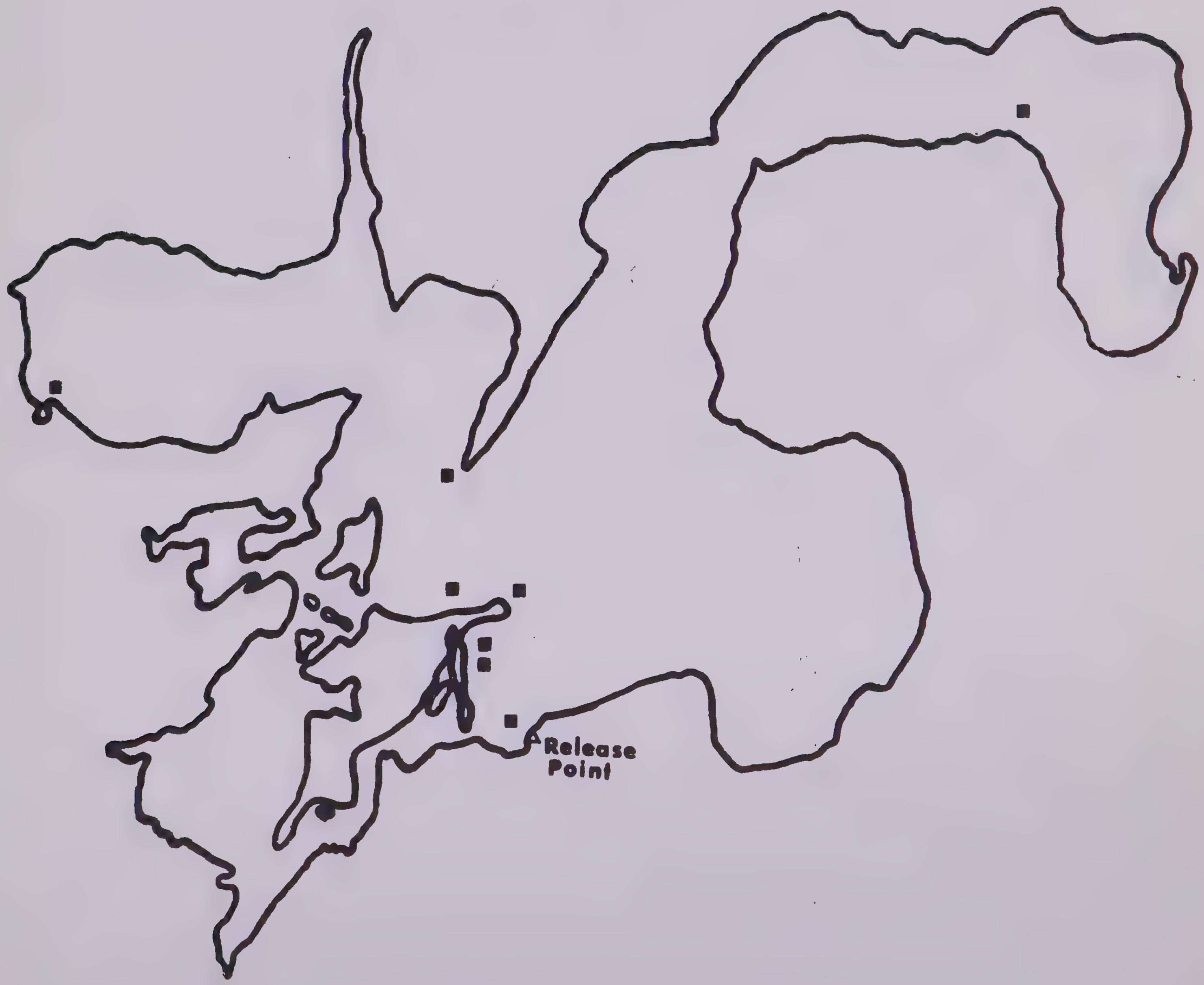


Figure 4 Location of Tagged Walleye Recaptures

Up to May, 1968

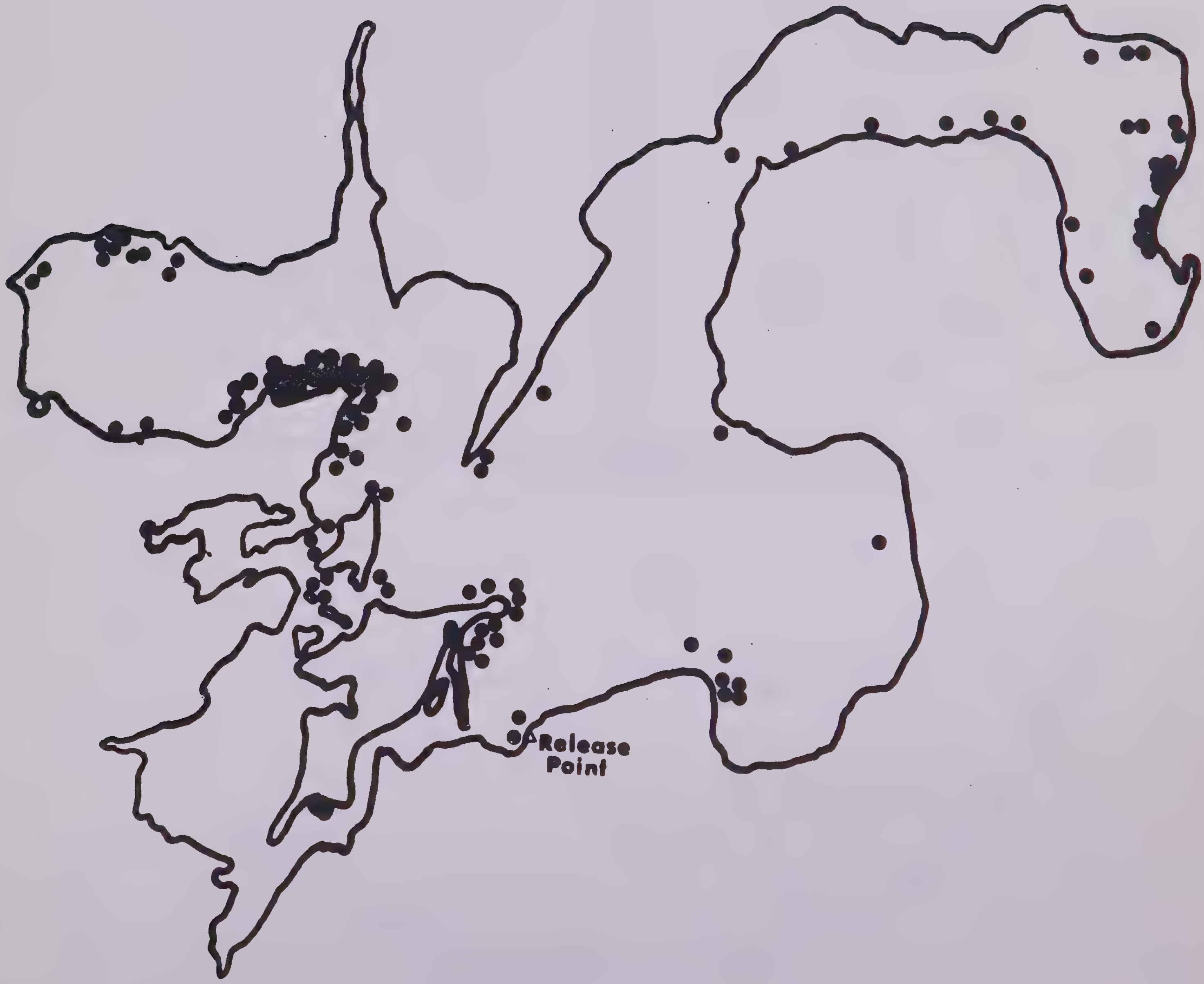
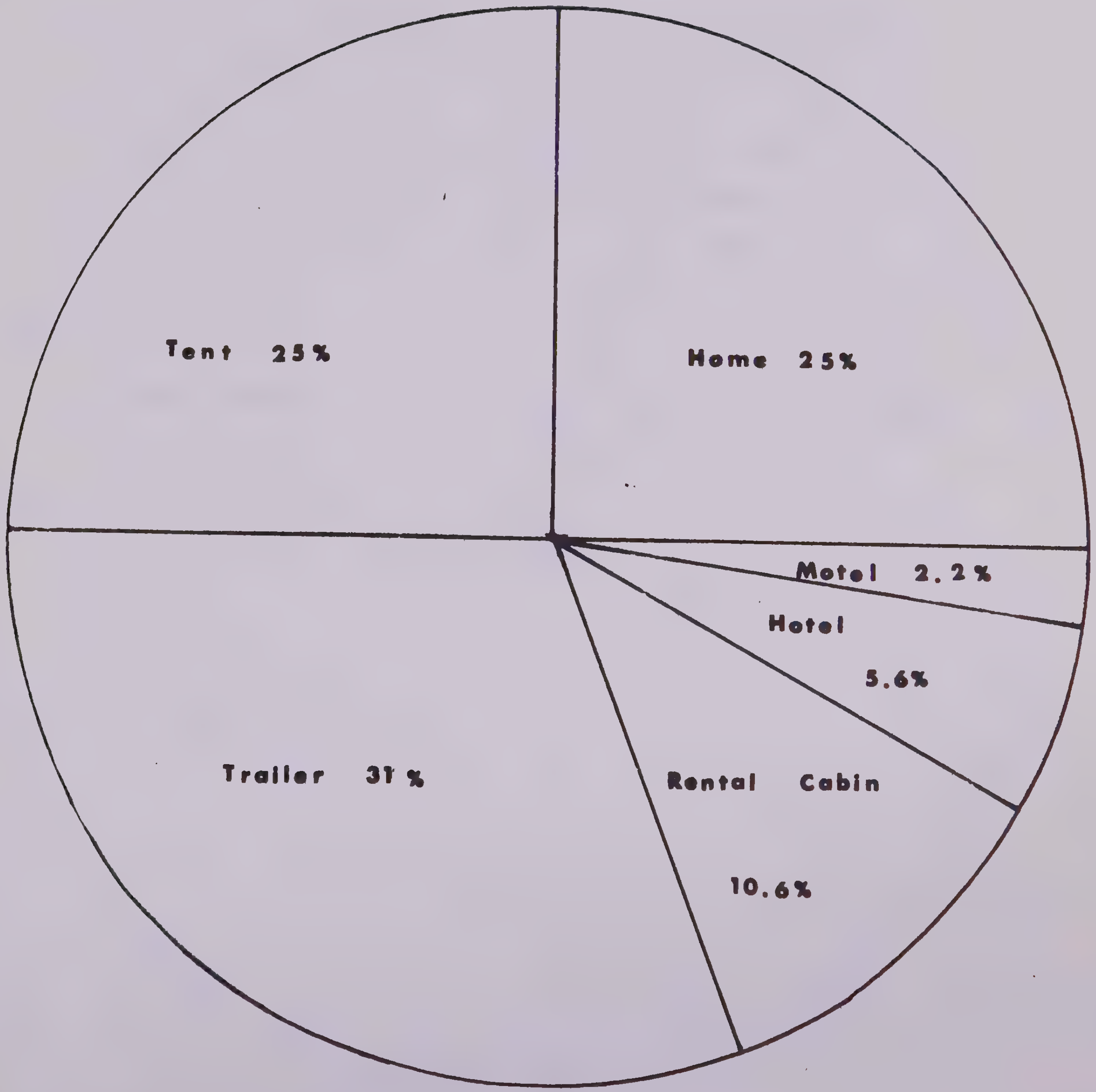


Figure 5 Type of Accomodation Used by Anglers

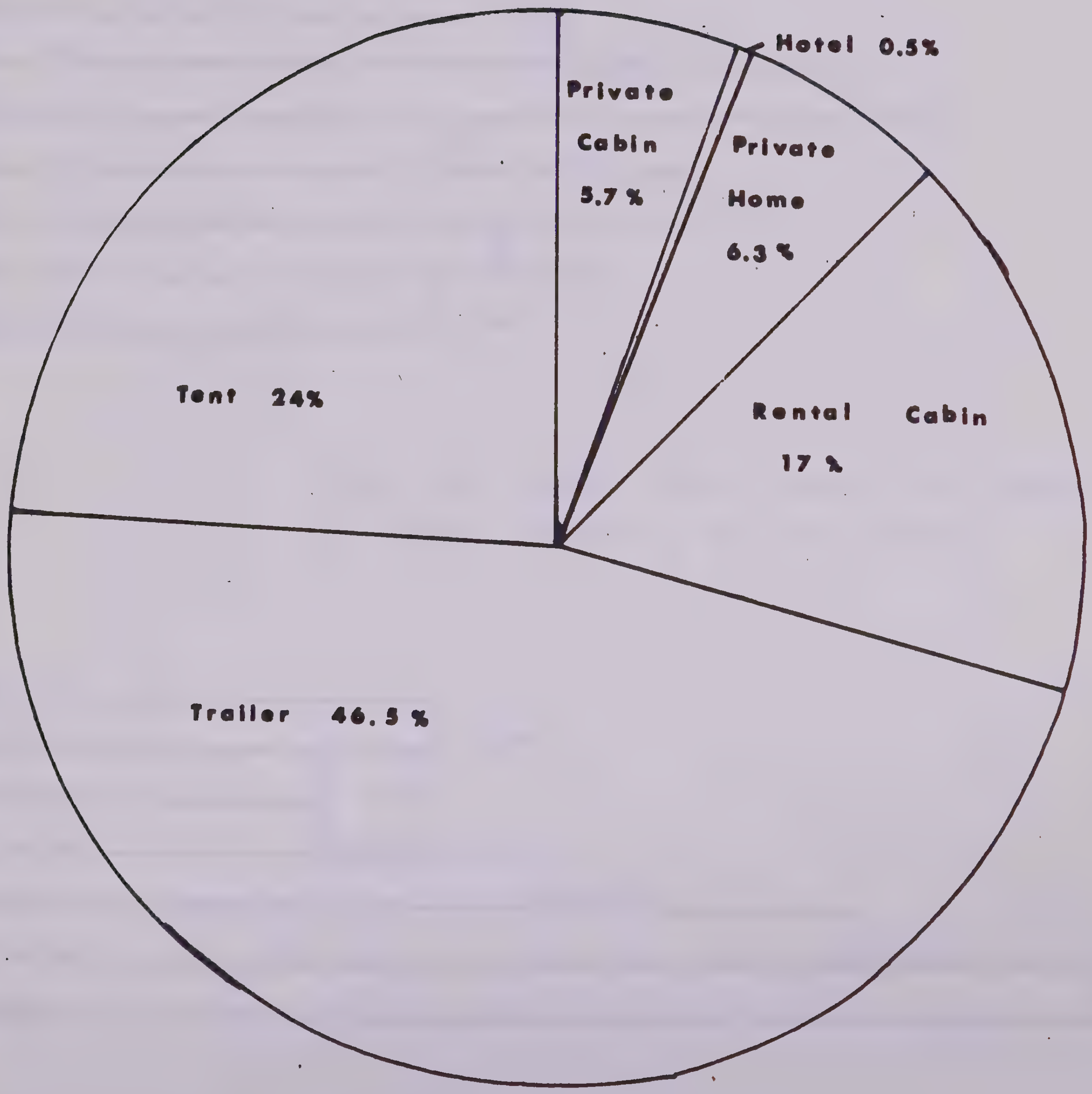
At Moose Lake in 1967



Private Cabin 0%

Figure 6 Type of Accomodation Most Preferred

By Anglers at Moose Lake



Motel 0%

Figure 7 One way distance which anglers are willing to travel for fishing for one day.

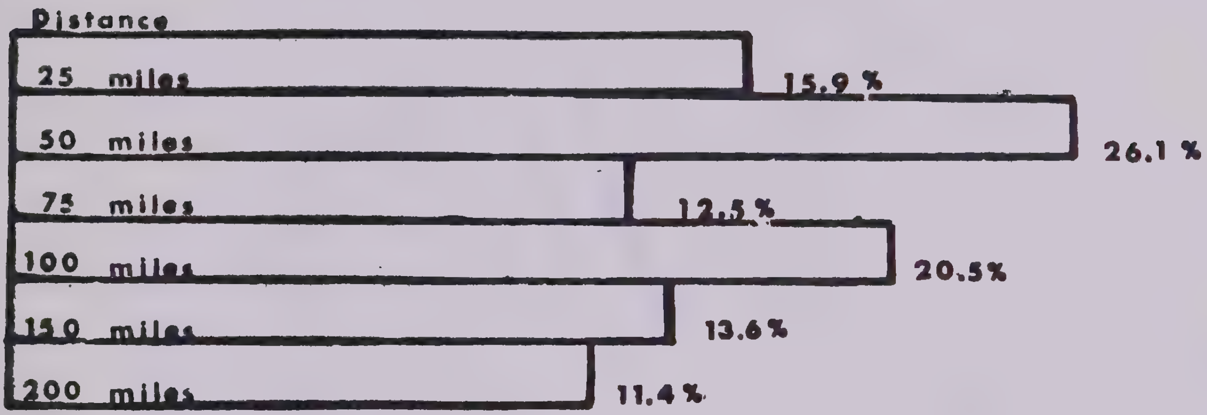


Figure 8 One way distance which anglers are willing to travel for fishing for one weekend.

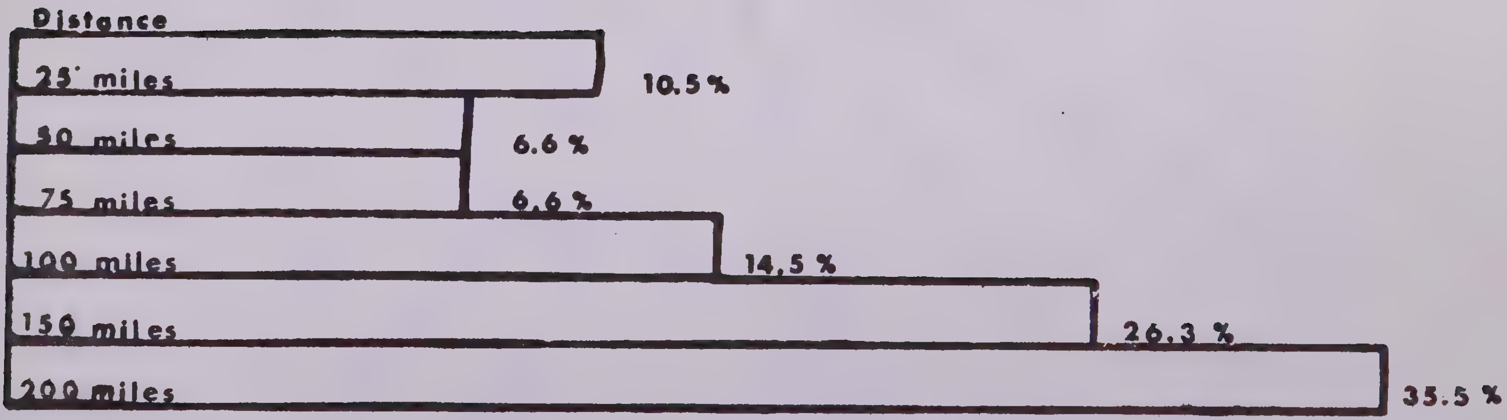
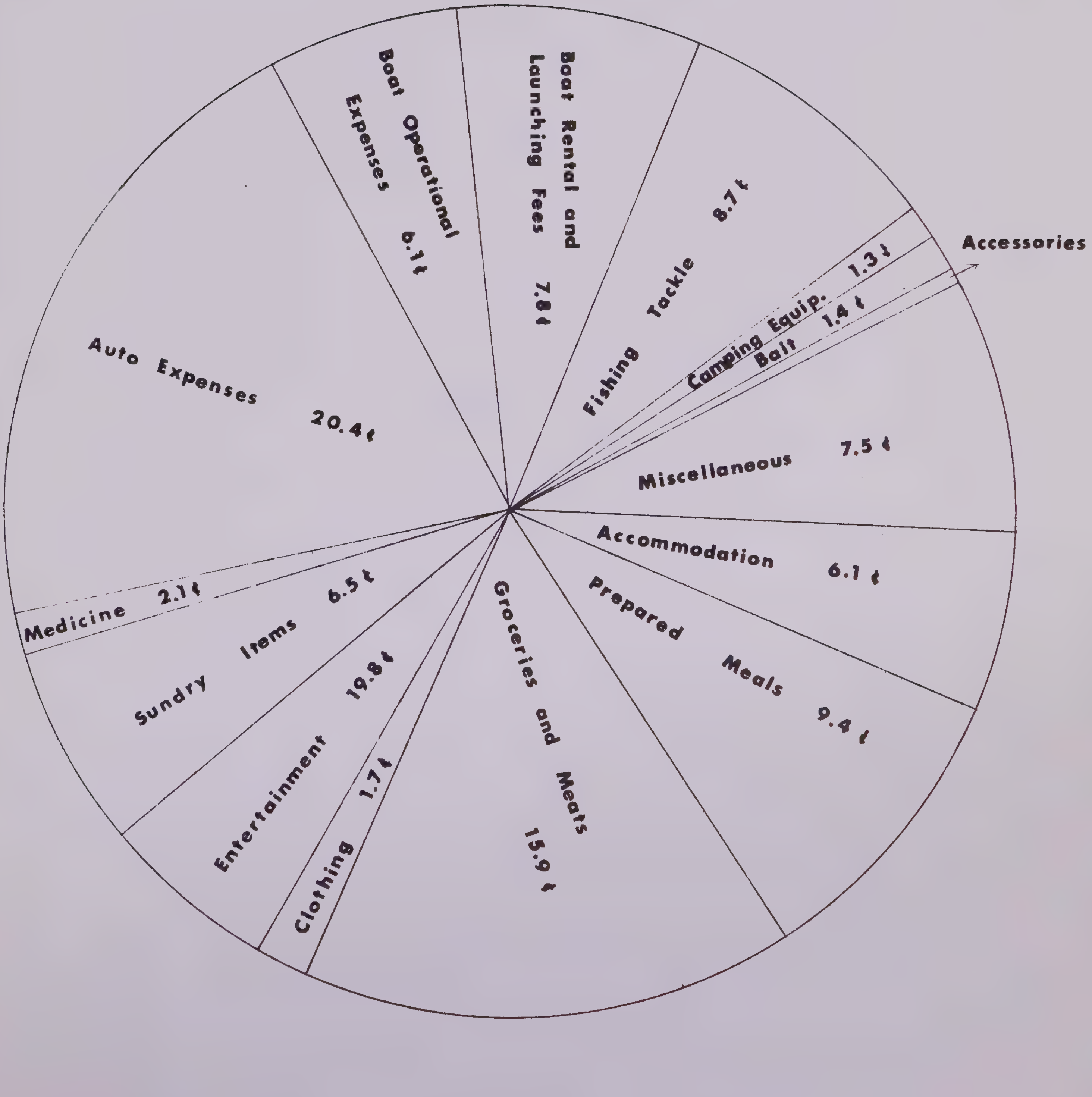


Figure 9 How an anglers dollar was spent in the Moose Lake - Bonnyville area - 1967



TABLES

TABLE 1. Schedule of 2.5 hour sampling periods at twelve census stations on Moose Lake in 1967. Numbers in table represent census stations as designated in Figure 1.

A.M. TIME OF DAY P.M.

WEEK DAY	6:00 - 8:30	8:30 - 11:00	11:00 - 1:30	1:30 - 4:00	4:00 - 6:30	6:30 - 9:00
Monday				1	2	3
Tuesday	4	5	6			
Wednesday				7	8	9
Thursday	10	11	12			
Friday				4	5	6
Saturday	7	8	9			
Sunday	DAY OFF					
Monday	DAY OFF					
Tuesday				10	11	12
Wednesday	1	2	3			
Thursday				2	3	4
Friday	2	3	5			
Saturday				6	7	8
Sunday	11	12	1			
Monday	DAY OFF					
Tuesday	DAY OFF					
Wednesday				9	10	11
Thursday	6	7	8			
Friday				5	6	7
Saturday	8	9	10			
Sunday				8	9	10
Monday	12	1	2			
Tuesday	DAY OFF					
Wednesday	DAY OFF					
Thursday				3	4	5
Friday	9	10	11			
Saturday				11	1	2
Sunday	3	4	4			
Monday				12	12	1
Tuesday	5	6	7			
Wednesday	DAY OFF					
Thursday	DAY OFF					
Friday	Repeat schedule over again					

TABLE 2 - FISHING EFFORT AND CATCH AT TWELVE SAMPLING AREAS ON MOOSE LAKE - MAY 20 - SEPTEMBER 12, 1967.

Census Area	Total No of Boat Trips Completed	Total No of Boat Trips For Pleasure	Total No of Boat Trips For Fishing	Total No of Man Trips	Total No of Man-Trips For Pleasure	Total No of Man Trips For Fishing	Total No of Man-Hours of Fishing	Total No of Fish Caught	No. of Pike Caught	No. of Perch Caught	No. of Walleye Caught	Total Weight of Fish Caught
1	497	33	464	1425	112	1313	—	928	862	33	33	—
2	32	0	32	64	0	64	—	64	32	32	0	—
3	431	0	431	1158	0	1158	—	99	66	33	0	—
4	313	69	244	1148	235	913	—	1148	835	104	209	—
5	209	70	139	766	238	528	—	1323	244	1044	35	—
6	—	—	—	1566	0	1566	—	1288	661	383	244	—
7	—	—	—	3697	0	3697	—	1464	1281	73	110	—
8	878	146	732	2562	496	2066	—	5234	2342	1501	1391	—
9	286	0	286	981	0	981	—	6591	450	3194	2047	—
10	116	0	116	425	0	425	—	812	348	193	271	—
11	549	37	512	1501	126	1375	—	4648	1903	1537	1208	—
12	256	0	256	914	0	914	—	2928	1647	915	366	—
TOTAL	3567	355	3212	16207	1207	15000	45150	25627	10671	9042	5914	33983 lb

TABLE 3 - NUMBER OF POUNDS OF FISH TAKEN FROM MOOSE LAKE IN 1967 BY COMMERCIAL FISHING

Species	Catch in Pounds
Northern Pike	236
Yellow Perch	165
Walleye	1,332
Lake Whitefish	12,541
Tullibee	17,944
TOTAL	32,218

APPENDIXES

APPENDIX A

TELEPHONE XXXXXX 422-6116

PLEASE QUOTE FILE NO.

GOVERNMENT OF THE PROVINCE OF ALBERTA

DEPARTMENT OF LANDS AND FORESTS

FISH AND WILDLIFE DIVISION

~~TERRACE BUILDING~~ 10526 Jasper Avenue
EDMONTON, ALBERTA.

April 26, 1967

A. Poitras
Bonnyville, Alberta

Dear Mr. Poitras

Last June the Fish and Wildlife Division of the Government of Alberta released 1,436 fish marked with yellow plastic tags into Moose Lake. This event marked the beginning of a project that will be continued on Moose Lake throughout 1967. The objectives of this project are numerous and include the following:

1) To determine the present rate of harvest of fish stocks in Moose Lake by sport fishing.
2) To determine the capability of Moose Lake to produce various species of game fish.
3) To determine the influence of social factors such as age, income, occupation, etc. on the sport fishery.
4) To determine how many fish are caught by anglers, how long they fish, what methods they use, what species they prefer to catch, etc.
5) To determine how much money anglers spend to fish in Moose Lake.
6) To determine what type of facilities anglers want at Moose Lake.

7) To determine what effect the development of parks and the improvement of roads in the Moose Lake area will have on the sports fishery.

The only way to obtain the information to satisfy many of these objectives is to contact those people who, like yourself, use Moose Lake and receive some benefit from it.

As a property owner at the lake, you are a member of a group that is not likely to be contacted during our regular creel census which is conducted entirely on public lands surrounding the lake. For this reason, it is necessary that you be contacted by mail. You have been randomly selected from the group of property owners in order to obtain information relating to this group. The information that we wish to obtain concerns the number of fishing trips that will be made from your property in 1967, the number of fish that will be caught, how many hours will be spent angling, etc. This information can only be accurately obtained by keeping a daily record of these activities. In addition to this, we wish to have you fill out a questionnaire providing information regarding your opinions on facilities at the lake, parks, highway improvement, etc.

If you are willing to assist us in this regard, we would appreciate having you forward your approval in the form of a short note in the envelope provided.

Following the receipt of your approval, we will forward a set of forms to you which will make the recording of the desired information as easy and convenient as possible. We will also enclose one copy of the questionnaire to be completed by yourself.

I urge you to consider this matter very carefully before making your decision and, hopefully, should you agree to assist us in the Moose Lake project, I would appreciate hearing from you at your earliest possible convenience.

Please permit me to point out that it is only through the co-operation and participation of people such as yourself that the Fish and Wildlife Division will be able to develop and implement a sound, effective fisheries management program for the Province of Alberta.

Best wishes for a very enjoyable and successful fishing season in 1967.

Sincerely,

SB Smith

S. B. Smith
Director of Fish and Wildlife

SBS/ep